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The Risk of Introducing Pests to Gilliam County, Oregon via Hawaiian Plastic-Baled Municipal Solid Waste

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Executive Summary

Proposals to move waste to mainland landfills in airtight bales

Companies are proposing to transport large volumes of municipal solid waste (MSW) in airtight bales from Hawaii to landfills in the continental United States. In a previous general pest risk assessment, CPHST found that the risk of introduction of pests from Hawaii via this pathway was insignificant. Here we assess a proposal by Waste Management Disposal Services of Oregon, Inc., to transport baled MSW to the Columbia Ridge Solid Waste Landfill in Gilliam County, Oregon. Our objective is to determine if the proposal entails any exceptional risks, due to different procedures or the specific transport route or location of the landfill that would justify a different recommendation than was made for the general pathway.

This assessment focuses on proposed transport to a landfill in Oregon

The company proposes to barge the baled MSW to one of two ports in Oregon: the primary location is Arlington (Gilliam County); the alternative location is Rainier (Columbia County). Bales will be transported to the landfill by truck from Arlington and by rail from Rainer. All transportation methods are low risk. The local environments and climates for the two ports and the Gilliam Country landfill do not pose exceptional risks. The climate in Gilliam County is drier and much colder than that in most Hawaiian cities and should mitigate the risk from tropical and sub-tropical pests. The landfill is a modern facility that complies with relevant federal regulations. The environment of Columbia County is milder that Gilliam County. None of the relevant Federal or State quarantine plant pests, which include insects, mollusks, pathogens and invasive plants, was found to present an exceptional threat of surviving, escaping and establishing via this pathway.

Transport means and route

Low risk conveyances

Unsuitable climate

Few relevant quarantine pests

This proposal largely followed the procedures outlined in the general pest risk assessment, and we found no factors that justified a pest risk rating other than Low risk. Transportation of baled Hawaiian MSW to Gilliam County, Oregon poses an insignificant risk of pest establishment. We recommend that the pathway be monitored to ensure that procedures and compliance do not differ significantly from what was described here and in the general pest risk assessment.

Risk rating different than Low Risk not justified

Introduction

Assess risk of plastic-baled waste from Hawaii

The Center for Plant Health Science and Technology (CPHST), at the request of Hawaii, conducted a general pest risk assessment to analyze the likelihood of introduction of pests into the continental United States via the transport of plastic-baled municipal solid waste (MSW) from Hawaii (CPHST, 2006). The MSW would be shredded, compressed, and wrapped in adhesive-backed, plastic film barriers made of low density polyethylene (LDPE), creating airtight packages. Bales would be transported by barge to a receiving facility on the mainland, moved by rail or truck to the landfills, and then buried intact in accordance with regulations for solid waste disposal (40CFR§258; EPA 1993), with each company transporting perhaps 300,000 tons of MSW per year. A pest risk assessment was required because garbage from Hawaii cannot enter the continental United States under current federal regulations for plant pests (7CFR§330.400). The assessment dealt only with parts of the pathway expected to be valid for any company proposing to transport the baled waste.

General pest risk assessment had Low risk ratings for plant pests.

In the general pest risk assessment, CPHST (2006) concluded that, if the planned procedures were followed, transportation of baled Hawaiian MSW posed an insignificant risk of pest establishment. Reasons included exclusion of most yard and agricultural waste from the pathway to greatly reduce the presence of potential plant pests or propagules in the bales; inability of insects, mollusks, and most pathogens to survive in the bales; and establishment of pathway procedures (e.g. monitoring during transport) to protect against escapes via accidental ruptures and punctures during handling and transport. A qualitative risk analysis indicated that the cumulative risk ratings for the introduction of insects, mollusks, pathogens, and weeds were each Low.

Waste Management proposed shipping baled MSW from Hawaii to a landfill in Gilliam County, Oregon

Waste Management Disposal Services of Oregon, Inc. (Waste Management or WMDSO) has proposed moving baled MSW from Hawaii to the Columbia Ridge Solid Waste Landfill (CRL) in Gilliam County, Oregon. Bales will be transported by barge to either Rainier or Arlington, Oregon, and then by truck or rail to the landfill. The objective of this assessment is to assess whether any exceptional risk factors in the proposal warrant a recommendation other than the Low risk rating given in the general pest risk assessment (CPHST, 2006). Although a baling technology provider has not been decided upon by WMDSO, the procedures proposed by Waste Management (2005) for transporting baled MSW will closely follow the procedures evaluated by CPHST (2006). Specific items considered here include the destination landfill, the Federal and State quarantine pests of concern, the type(s) of transportation used to move bales after reaching the mainland, and any other notable factors in the proposal.

Definitions of key terms

Definition of 'garbage'

Garbage is defined as urban (commercial and residential) solid waste from Hawaiian municipalities. Based on company proposals to move baled MSW (not shown), this analysis assumes that yard and agricultural waste will be actively excluded from the waste stream.

Definition of a 'spill'

A **spill** is defined as the escape of waste material from a bale and contact with the ground, truck, tractor, barge, or other terrestrial feature.

Other definitions

Other important terms are defined as follows Merriam-Webster (2004):

Anaerobic: Living, active, occurring, or existing in the absence of free oxygen. The term only correctly applies to organisms, not non-living things like bales or the conditions within them

Anoxia: Hypoxia especially of such severity as to result in permanent damage

Anoxic: Greatly deficient in oxygen

Hypoxia: A deficiency of oxygen reaching the tissues of the body

Basic Proposal

Eight important details

Following are some important details from the proposal by Waste Management (2005).

Agricultural and yard waste separated

1) Agricultural and yard waste will be separated, or diverted to other disposal sites, so that it does not enter the pathway.

Bale specifications

2) The waste compression and baling system used will create rectangular bales weighing 2 to 3 tons, with a density of about 1600 to 2000 pounds per cubic yard (approx. 950 to 1200 kg/m^3). Densities should be about 1000 kg/m^3 (CPHST, 2006).

Bale staging conditions

3) WMDSO did not specifically state that bales would not be allowed to contact soil or other moist surfaces and to be distanced from vegetation, but they mentioned that bales would be kept in quarantine. New processing facilities built in Hawaii need to accommodate this requirement.

Shipping 120,000 tons annually

4) Estimated shipping an annual maximum of 120,000 tons (Willmann, 2007).

Two transportation route options

5) Bales will be moved up the Columbia River by barge, and then to the landfill by one of the following routes (Fig. 1):

Barge then truck

a) 210 miles up river to the Port of Arlington, Oregon (Gilliam County), then approx. 10 miles on truck and flatbed trailer to the landfill; or

Barge then rail

b) 52 nautical miles to a facility at Rainier, OR, near Portland, then approximately 130 miles by rail flatcar to the landfill.

Tracking bales

6) Track bales using an electronic manifesting system.

Monitor bales for damage

7) Monitor bales for ruptures and punctures, and patch ruptured bales when and where found.

Transport in industrial bags if repair is not possible

Proposed bagging spills differs from previous proposals, but rewrapping restaging will be required in Hawaii.

8) If patching is not possible, MSW proposed that bale will be contained and transported to the landfill in one or more industrial-grade bags (Super Sack®, B.A.G. Corp., Dallas, TX), with MSW inside 6-ml LPE liners. Liners will be hand-closed to create an airtight package (Willmann, 2005). The bales will need to be re-wrapped and re-staged if damage occurs in Hawaii. If the bale damaged is beyond patching and in route to Oregon or in Oregon, the bag protocol can be used. Though probably slightly inferior to re-baling, in terms of compression and forced evacuation of air, it offers the advantage of quickly collecting and sealing the MSW with less handling than if the MSW were put through the baling process again. As with bales (CPHST, 2006), the packages would be re-staged for several days before transport re-starts. If the clean-up, disinfection, and bag sealing procedures described in the Waste Management proposal (2005) are followed, we think the pest risk mitigation will be equally effective.

Destination landfill

Columbia Ridge Recycling and Landfill meets EPA guidelines

The CRL (www.wmnorthwest.com/landfill/landfillcities/columbia.html) in Gilliam County, near the town of Arlington (Fig. 2), is modern and meets regulations and EPA guidelines for design and operation, e.g. EPA (1993). We expect proper landfilling of bales at this site, and therefore the mitigation likely to come from landfilling seems valid (CPHST, 2006).

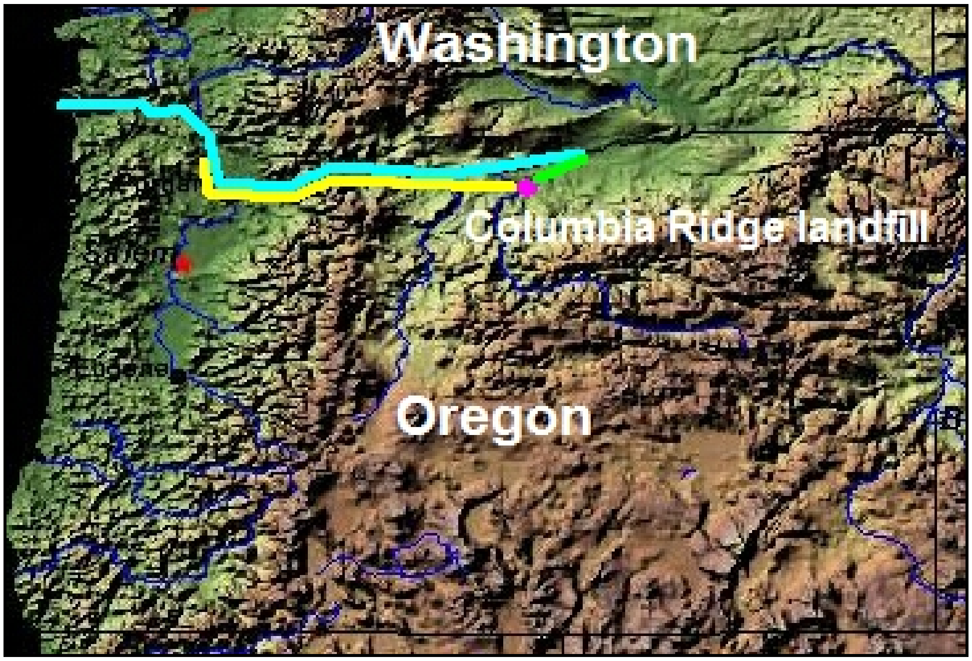

Figure 1. Map showing the transport route by barge (light blue), and either rail (yellow) or truck (green) for baled MSW to the Columbia Ridge Landfill in Oregon.

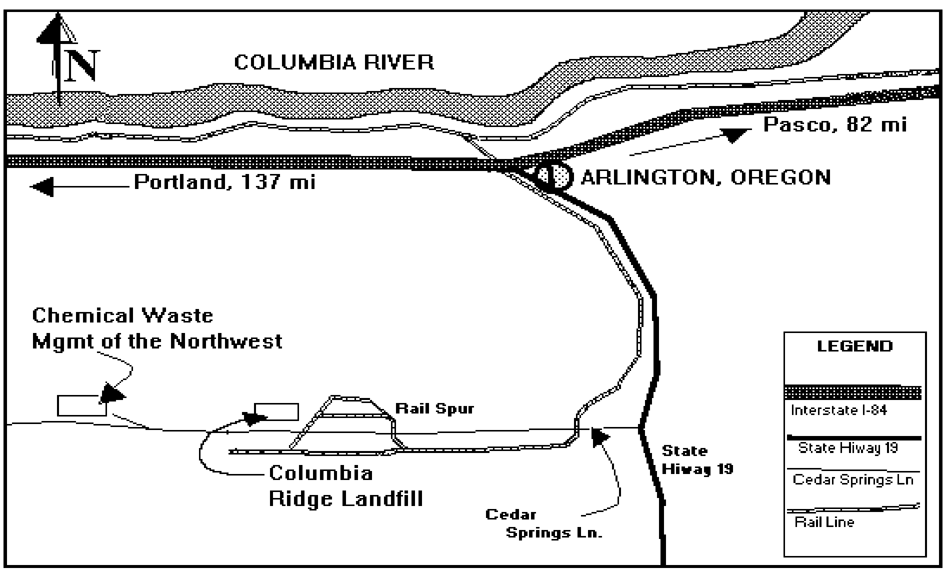

Figure 2. Map of Columbia Ridge Landfill and surrounding locations.

Transportation of bales

Quantitative risk for transportation modes and routes

As discussed above, bales will be barged up the Columbia River, and then moved either onto trucks or onto railcars (Willmann, 2007). The generic quantitative risk analysis for bale-rupturing accidents to transport of bales (CPHST, 2006) and modified (CPHST, 2007,

Appendix A) was further adapted for the two routes proposed by Waste Management to the CRL. The proposed use of tandem tows (two barges towed inline) decreased the number of trips by half. The impact of accident rate on the tandem towing of barges was not examined. The two proposed routes and associated risks follow.

Tandem tows decrease number of trips

Main route option

Barge then truck

Unloading at the Willow Creek Barge Facility, Port of Arlington and trucking to the CRL requires an increase from 140 barge miles in the generic model to 210 miles, and a decrease in truck miles from 25 to 10.

Mean years to first bale-rupturing accident was 2,222 for trucks and 246 for barges

Low Risk route overall

The risk of any bale-rupturing accident for trucks was 0.00045, while that for barges was 0.0041. Mean years to the first bale-rupturing accident for trucks was 2,222, and that for barges was 246. We found a 95 percent chance that the first truck accident would occur only after 5444 years, or after 1391years for barge transport. The risk of catastrophic rupture of bales while they are being transported by truck or barge to CRL is therefore Low.

Alternate route option

Barge then rail

Unloading in Rainier, Oregon, and transporting by rail to CRL reduces rail miles in the model from 500 to 180, and barge distance from 140 to 52 nautical miles.

Mean years to first bale-rupturing accident was 2222 for trucks and 247 for barges

The risk of any bale-rupturing accident by train was 0.00002, while that for barges was 0.0077. Mean years to the first bale-rupturing accident for trains was 50,000.4, and for barges was 130. We found a 95 percent chance that the first train accident would occur only after 921 years, or after 554 years for barge transport. The risk of catastrophic rupture of bales while they are being transported by truck or barge to CRL is therefore Low.

Local environment and climate comparison to Hawaii

Climate in Hawaii

The tropical climate in Hawaii is characterized by relatively uniform day lengths and temperatures (Western Regional Climate Center, 2007). Annual climatic averages for Honolulu (Oahu) are maximum temperature = 84.0 °F, minimum temperature = 70.2 °F, and total precipitation = 20.7 inches (52.6 cm), while the same averages for Hilo (Hawaii) are maximum temperature = 81.2 °F, minimum temperature = 66.3 °F, and total precipitation = 128.2 inches (3.25 m) (Western Regional Climate Center, 2007).

Gilliam County in rain shadow

Gilliam County lies in the eastern rain shadow of the coastal Cascade Mountains (Department of Assessment and GIS, 2003).

Mean annual precipitation is only about 15 inches (38 cm), and most falls during the winter (Taylor et al., 2005). The mean (annual) daily maximum temperature in the county is 58.7 °F, and the mean daily minimum is 35.7 °F. That is about 20 °F less than the mean maximum temperatures in Hawaii, and about 30 °F less than the mean minimum temperatures. In addition, mean annual snowfall in the central part of Gilliam County is about 18 inches (45.7 cm; equal to approximately 4.6 cm of rainfall). Thus, Gilliam County is drier and much colder than most municipalities in Hawaii. Most of the transport route (Fig. 1) is also in the rain shadow of the coastal range, and therefore would also be significantly drier and colder.

Climate is arid and cold in comparison to Hawaii

Gilliam County is in the main wheat-producing area of Oregon. Most acreage in the county is devoted to wheat, followed by forage and barley (National Agricultural Statistics Service, 2004). Apples, grapes and other irrigated crops are found in the northern part of the county.

Local agriculture: Wheat predominate crop in the area

Rainier is in Columbia County, OR. We used weather information for Longview, WA, which is directly across the Columbia River from Rainier. Rainier and Longview have climates which are more moist and mild than that of Arlington (Western Regional Climate Center, 2007). The annual climatic averages for Longview range from an average maximum temperature of 61.7 °F to an average minimum temperature of 41.8 °F (Western Regional Climate Center, 2007). The total annual precipitation averages 46.3 inches (18.2 cm), with an annual average snowfall of 4.9 inches (1.9 cm) (Western Regional Climate Center, 2007).

Climate of Rainier based on Longview, WA,

Though much colder than Hawaii, annual precipitation in Rainier is between the averages recorded for Honolulu and Hilo. Thus, compared to Arlington, the Rainier area poses a greater pest establishment risk.

Annual precipitation at Rainier is similar to that of Hawaii

Potential plant pests

Quarantine plant pests from Hawaii include pathogens, mollusks, insects, and invasive plants (CPHST, 2006). We expect an extremely low incidence of these pests in Hawaiian municipal solid waste (CPHST, 2006). In addition to federal quarantines, Oregon has state plant pest quarantines in Gilliam County for apple maggot (603-052-0121), small broomrape (603-052-1025) and noxious weeds (603-052-1200).

We expect a low incidence of pests in baled MSW

Insects

Of the insect pests of concern to the Oregon nursery industry, two,

Insects are highly unlikely

to survive in bales

Popillia japonica (Japanese beetle) and *Homalodisca coagulata* (Say) (glassy winged sharpshooter), are present in Hawaii (Table 1). Some insects in Hawaii are Federal quarantine pests (Table 2). We do not discuss insects further since they are highly unlikely to survive in the bales (CPHST, 2006).

Invasive plants

Definition of category A noxious plant

In Oregon, Category "A" noxious plant species are defined as "Weeds of known economic importance which occur in the state in small enough infestations to make eradication or containment possible; or which are not known to occur, but their presence in neighboring states makes future occurrence in Oregon seem imminent" (Oregon Department of Agriculture, 2005). Only four of these Category "A" species are present in Hawaii, according to USDA NRCS (2004), Imada et al. (2007), Bishop Museum (2004), and Wagner et al. (1999). Those species are *Cyperus rotundus* L. (purple nutsedge), *Hydrilla verticillata* (hydrilla), *Pueraria lobata* (Willd.) Ohwi (kudzu), and *Solanum elaeagnifolium* Cav. (silverleaf nightshade).

Four category A noxious weeds present in Hawaii

Aquatic weed, Hydrilla

Hydrilla, an aquatic species, may present a risk to the Rainer, Oregon, area, but the arid conditions in Gilliam County would greatly mitigate the risk. Furthermore, hydrilla relies greatly on reproduction from leaf fragments (Kay and Hoyle, 2007), which would not be possible via this pathway because plant material would not survive in the bales.

Two other noxious weeds produce seed with low viability

Weed seed viability may be unaffected by bale conditions in general, but the seeds are highly unlikely to escape and contact a suitable growth environment. In addition, the kudzu (Susko et al., 2001) and *Cyperus rotundus* (Justice and Whitehead, 1946) seeds only have about 10 percent viability. The vegetative nutlets of *C. rotundus* are produced in the soil, and therefore, are much less likely than seeds to be present in MSW. As in the PRA for Washington state (CPHST, 2005), the risk from invasive plants in baled MSW is Low.

Mollusks

Mollusks present concern as hitchhikers

Federal quarantine phytophagous snails occur in Hawaii (Robinson, 2006; Table 3) and may be a risk to hitchhike on bales. Mollusks have been detected in pre-departure and permitted cargo from Hawaii headed by air to the continental United States (AQAS, 2007), but not in maritime shipments, for which less inspection data is available. Smith and Fowler (2003) rated the risk for movement of *A. fulica* by cargo and empty containers as Low, partly because the large size of the snail facilitates detection. Contact of bales with moist substrates (Robinson, 2006), such as soil or mulch, increases the likelihood that mollusks can become established.

Suitability of climate

The climate in Oregon is suitable for at least one species, *Achatina fulica* (Smith and Fowler, 2003). We do not know if the climate is suitable for other species such as *C. aspersum*, but that species has been a problem pest in California for many years (Grafton-Cardwell et al., 2005). Dispersal from there probably poses a greater risk.

C. aspersum already present in California

Proper staging and certification mitigates risk from mollusks

Staging bales in Hawaii on impermeable surfaces away from vegetation sources, and certification of bales by the company as mollusk-free (CPHST, 2006; Robinson, 2006) should make them Low Risk.

Plant pathogens

Some quarantine plant pathogens present in Hawaii

Some bacterial, fungal, and viral diseases of plants under Federal or Oregon quarantine are present in Hawaii and the pathogens could be transported (Tables 3 and 4). Oregon has a general pest quarantine against grapes (*Vitis* spp.) (excluding table grapes, *V. labrusca*), but we found no pathogens of grapes in Hawaii. For various reasons, the plant pathogens listed in Tables 3 and 4 are very unlikely to establish in Oregon via this pathway (Table 5).

Table 1. List of insect species of quarantine concern to the Oregon nursery industry (Oregon Department of Agriculture, 2006) with recorded presence in Hawaii (HDOA, 2004; Nishida (ed.), 2002).

Scientific Name	Common Name	Present in HI?
Conotrachelus nenuphar	Plum Curculio	No
Homalodisca coagulata	Glassy Winged Sharpshooter	Yes
Ostrinia nubilalis	European Corn Borer	No
Oulema melanopus	Cereal Leaf Beetle	No
Popillia japonica	Japanese Beetle	Yes
Rhagoletis mendax	Blueberry Maggot	No
Rhyacionia buoliana	European Pine Shoot Moth	No
Tomicus piniperda	Pine Shoot Beetle	No
Yponomeuta malinellus	Apple Ermine Moth	No

Table 2. Selected Federal quarantined insects present in Hawaii relevant to Oregon ecosystems.

Scientific name (Order: Family)	**Common name**	**Reference**[1]
Adoretus sinicus (Coleoptera: Scarabaeidae)	Chinese rose beetle	7 CFR§318.13
Adoretus sp.	–	7 CFR§318.60
Bactrocera cucurbitae (Diptera: Tephritidae)	melon fly	7 CFR§318.13
Bactrocera dorsalis (Diptera: Tephritidae)	Oriental fruit fly	7 CFR§318.13
Cactoblastis cactorum (Lepidoptera: Pyralidae)	cactus borer	7 CFR§318.13
Ceratitis capitata (Diptera: Tephritidae)	Mediterranean fruit fly	7 CFR§318.13
Coccus viridis (Hemiptera: Coccidae)	green scale	7 CFR§318.13
Chilo suppressalis (Lepidoptera: Crambidae)	Asiatic rice borer	7 CFR§318.13
Eriophyes gossypii (Acarina: Eriophyidae)	cotton blister mite	7 CFR§318.47
Euscepes postfasciatus (Coleoptera: Curculionidae)	sweet potato scarabee	7 CFR§318.30
Lampides boeticus (Lepidoptera: Lycaenidae)	bean butterfly	7 CFR§318.13
Maruca testulalis (Lepidoptera: Pyralidae)	bean pod borer	7 CFR§318.13
Omphisa anastomosalis (Lepidoptera: Pyralidae)	sweet potato stem borer	7 CFR§318.30
Pectinophora gossypiella (Lepidoptera: Gelechiidae)	pink bollworm	7 CFR§318.47
Phyllophaga spp. (Coleoptera: Scarabaeidae)	white grubs	7 CFR§318.60
Phytalus sp. (Coleoptera: Scarabaeidae)	white grubs	7 CFR§318.60
Sternochetus mangiferae (Coleoptera: Curculionidae) synonym: *Cryptorhynchus mangiferae*	mango seed weevil	7 CFR§318.13

[1] CFR = Code of Federal Regulations

Table 3. Federal quarantined and regulated pathogens, nematodes and mollusks present in Hawaii that are relevant to Oregon ecosystems.

Scientific name [1]	**Common name**	**Reference(s)**
Mollusca: Achatinidae		
Achatina fulica Bowdich	giant African land snail	Cowie, 1977; 2002b; Robinson, 2006
Mollusca: Ampullaridae		
Pila ampullacea (Linné)	"apple snail"	Robinson, 2006
Pila conica (Wood)	"apple snail"	Robinson, 2006
Pila sp.	"apple snail"	Robinson, 2006
Pomacea canaliculata (Lamarck) [2]	channelled apple snail	Cowie, 1977; 2002b; Robinson, 2006
Mollusca: Helicidae		
Cornu aspersum (Müller) [Syn. *Cryptomphalus aspersus* (Müller); *Helix aspersa* Müller]	brown garden snail	Cowie, 1977; 2002b; Robinson, 2006
Mollusca: Helicarionidae		
Parmarion cf. *martensi* (Simroth) [tentative identification]	a semi-slug [3]	Robinson, 2006
Mollusca: Philomycidae		
Meghimatium striatum (Hasselt)	a terrestial snail	Cowie, 2002a; Robinson, 2006

Scientific name [1]	Common name	Reference(s)
Mollusca: Sublinidae		
Paropeas achatinaceum (Pfeiffer)	a snail	Robinson, 2006
Mollusca: Veronicellidae		
Laevicaulis alte (Férussac)	tropical leatherleaf – thrives in arid biotopes	Cowie, 1977; 2002b
Veroncella cubensis (Pfeiffer)	two striped slug or Cuban slug	Cowie, 1977; 2002b; Robinson 2006
Nematoda: Meloidogynidae		
Meloidogyne konaensis	root-knot nematode	Zhang and Schmitt, 1994
Bacterium: Xanthomonadales		
Xanthomonas albilineans (Ashby) Dowson	sugarcane leaf scald	USDA-APHIS-PPQ, 2003
X. axonopodis pv *vasculorum* (Cobb 1894) Vauterin, Hoste, Kersters & Swings Synonym: *X. vasculorum*	sugarcane gumming disease	USDA-APHIS-PPQ, 2003

[1] Family is listed for nematodes and mollusks; Order is listed for bacteria.
[2] Three other species occur in Hawaii, but this is the worst pest in that genus.
[3] Carrier of the human parasitic nematode, *Angiostrongylus cantonensis*

Table 4. Plant pathogens and parasitic nematodes of concern in Oregon (Division of Plant Industries, 2005), and present in Hawaii (CABI, 2005; Raabe et al., 1981; University of Hawaii and Hawaii Department of Agriculture, 2004; USDA-APHIS-PPQ, 2003).

Scientific name	Common name
Bean common mosaic virus (strain US-6)[2,4]	bean common mosaic virus
Colletotrichum truncatum[4]	lentil anthracnose
Colletotrichum lindemuthianum[1,3,4]	bean anthracnose
Curtobacterium flaccumfaciens pv *flaccumfaciens*[2,3,4]	bacterial wilt of beans
Ditylenchus dipsaci (onion race)[5]	onion stem and bulb nematode
Fusarium graminearum[2,5]	wheat scab
Phakopsora pachyrhizi[4]	soybean rust
Phytophthora infestans[5]	potato late blight
Pseudomonas savastanoi pv *phaseolicola*[2,3,4] synonym: *P. syringae* pv *phaseolicola*	halo blight of beans
Pseudomonas syringae pv *syringae*[2,3,5]	bacterial brown spot of beans
Sclerotium cepivorum[2,3,5]	onion white rot
Xanthomonas axonopodis pv *phaseoli* [3,4] synonym: *X. campestris* pv *phaseoli*	common blight of beans

[1] Reported present in Hawaii (CABI, 2005) and under control in Malheur County by Oregon Department of Agriculture (2007) (Oregon Revised Statutes (ORS) 570.405 to 570.435).
[2] Reported present in Oregon by CABI (2005). Bean diseases are under control in Malheur County by Oregon Department of Agriculture (2007) (ORS 570.405 to 570.435).
[3] Pests of moderate to high concern.
[4] Not known to occur or not detected in Oregon.
[5] Limited distribution or newly established.

Table 5. Rationales for pathogens being low risk for introduction and establishment in Oregon via baled solid waste from Hawaii.

Common/scientific name	Rationale for low risk rating
bacterial brown spot of beans bacterial wilt of beans common blight of beans halo blight of beans sugarcane gumming disease sugarcane leaf scald	▪ Aerobic bacteria need oxygen (Wener, 2005) and are unlikely to survive in bales ▪ Survival declines for free bacteria, i.e., not in contact with suitable host material (Agrios, 2005)
bean anthracnose lentil anthracnose	▪ Primarily seedborne (CABI, 2005), so unlikely to be present in the bale or to disperse after escape ▪ Dormant agents may require oxygen
bean common mosaic virus (strain US-6)	▪ Seedborne and aphid-vectored (CABI, 2005); aphids cannot survive and infected seeds are unlikely to be present ▪ Only multiplies in living cells (Agrios, 2005) and suitable host plants would either not enter or survive in the bales
onion stem and bulb nematode	▪ Needs oxygen for survival ▪ Seedborne (CABI, 2005), so unlikely to be present or to disperse after escape ▪ Most stages need host material for survival (CABI, 2005) ▪ Fourth stage juveniles survive for years without a host, but populations decline rapidly (CABI, 2005) and are not likely to survive other bale conditions (e.g., compression, anoxia)
onion white rot	▪ Fungus is unlikely to survive anoxic conditions in the bale ▪ Dormant sclerotia germinate only in the presence in soil of specific root exudates from *Allium* spp. (CABI, 2005)
potato late blight	▪ Dormant agents may need oxygen for survival ▪ Except for oospores, a living host or crop debris is required for survival (CABI, 2005), which are unlikely to be present or to survive in the bales ▪ The asexual stage only occurs in contact with living host material (Agrios, 2005; CABI, 2005), which is unlikely to be present in the pathway
root-knot nematode	▪ Dormant agents may need oxygen for survival ▪ Cool temperatures are expected to kill eggs (Schmitt, 2002) ▪ Nematode has limited tolerance to changes in temperature (prefers 75±10 °F), so climatic conditions in Oregon would probably prevent long-term establishment (Schmitt, 2002) ▪ Dispersal is primarily via roots and tubers, or by field equipment (Agrios, 2005), which are both unlikely to occur
soybean rust	▪ Obligate parasite can only survive on live plant material, which would not survive in the bales
wheat scab	▪ Seedborne; requires host material for survival (CABI, 2005), which is very unlikely to be present ▪ Needs oxygen for survival

Conclusions

We found no exceptional pest risks

We found no significant exceptional pest risks related to the WMDSO proposal to take baled MSW to the CRL that justified a conclusion different from that given in CPHST (2006).

Three notable mitigating factors

A few mitigating factors seemed particularly noteworthy:

- The climate in Gilliam County is very different from that of Hawaii;
- Very few relevant invasive plant species in Oregon are present in Hawaii; and
- The risks from relevant diseases and pathogens seem likely to be effectively mitigated by the bale technology and other factors.

Overall Low Risk of pest establishment

Overall, transportation of urban solid waste from Hawaii to the CRL in Oregon by WMDSO in plastic-wrapped, airtight bales poses a **Low risk** of pest establishment. Perhaps the greatest pest risk is from hitchhikers, so we strongly recommend that bales be certified mollusk-free by the company (subject to audit by USDA APHIS).

Both routes with conveyances were Low risk for bale-rupturing accidents

The two routes proposed, barge plus truck or barge plus rail, were both Low risk for accidents. However, in the alternate route the unloading site of Rainier, Oregon, has a milder climate and represents an increased possibility of establishment by hitchhiking mollusks and other pests.

This assessment only dealt with pest risks

The pathway may be disallowed for other reasons

Last, we only addressed the pest risk associated with the proposal by WMDSO to move baled MSW from Hawaii to Oregon. Complete approval of the proposal (pathway) or particular procedures should not be inferred. The pathway and proposal in question may still be subject to denial or modification, in whole or in part, based upon other constraints (pest or non-pest related), such as available resources or other State or Federal regulations.

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